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ACADEMIC MEDICINE

Rising Cost of NIH-Funded Research
Calls for Change in Academic Medicine
Three Easy Pieces
A Focus for Change
Physician Education
AAMC Annual Awards
"Certifimania" in Medical Education
Teaching Critical Thinking
Women's and Men's Research Activities
Information-Gathering Strategies
Improving Oncology Education
Role of Nonphysician Consultants

VOLUME 65 • NUMBER TWO

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JOURNAL OF THE
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INVITED ARTICLES

THOMAS J. KENNEDY, JR., M.D.

The Rising Cost of NIH-Funded Biomedical Research?

Abstract—During the last decade, total appropriations for the NIH have grown in current as well as constant dollars. Constant dollar expenditures for indirect costs and research project grants have increased, as also has the number of the latter, while such expenditures for research centers, training, and research contracts have shrunk. The most impressive redistribution in emphasis has been toward traditional research project grants (R01s). The size of the average R01 award, discounted for inflation, has grown at an annual rate of 1.1% during the last decade and 1.3% since fiscal year (FY) 1970; that of the average research program project (P01) has declined over the same periods, after a slight rise in the early 1970s. Factors contributing to the modest rise in the real (constant-dollar) size of the average R01 are explored. The regularity with which current-services-requirements estimates for the NIH exceed inflation reflects real growth in the program, particularly in the category of research project grants; the artifact of basing calculations on the post- rather than pre-"negotiated" levels of awards in the "current" year; and the extent to which the project periods of awards have been extended. The effect of lengthening project periods is slow to become manifest, but inexorably swells the pool of non-competing awards; decisions in this area undertaken in 1985, and continued at least through FY 1988, could very significantly increase current services requirements in FYs 1991 and 1992. *Acad. Med.* 65(1990):63–73.

For almost a decade, the federal government has been operating under a fiscal policy that has resulted in novel restraints and limitations. An examination of what effects that policy has had on the federal support of health research and what the prospects might be for future support seems timely. Since the bulk of federal funding for health research is channeled through the National Institutes of Health (NIH), the analysis reported in the present article has focused on the programs of that agency and has relied heavily on NIH publications as well as direct communication with NIH staff. The interpretations and speculations are entirely personal.

Understanding the fiscal climate that has prevailed in the nation during recent years is essential for evaluating historic and prospective changes in the patterns of federal support for biomedical research programs. A useful place to begin is with the major reduction in tax rates that occurred in 1982, thereby reducing revenues relative to outlays, with a consequent increase in the deficit.[1] (See Table 1.) This is most clearly evident when revenues and outlays are expressed as percentages of a rising Gross National Product (GNP) but is also seen in dollar terms where growth in outlays outpaced that for revenues by a substantial margin.

The absolute value of the deficit had reached such alarming proportions that Congress moved to control it through The Balanced Budget and Emergency Deficit Control Act of 1985, better known as the Gramm-Rudman-Hollings legislation. The essential mandate of this law is systematic reduction of the annual deficit, scheduled to reach zero in fiscal year (FY) 1992. It does not specify how the debt should be reduced but, without any parallel move to increase revenues, the only device to achieve the goal has been to curtail expenditures. Severe pain was postponed for a while, but the vise has steadily tightened. Many federal programs—Preventive Health Services block grants, the National Center for Health Services Research, the National Health Service Corps, and public housing—have experienced real and deep cuts. Others that may have enjoyed modest increases—the Alcohol, Drug Abuse, and Mental Health Administration, the Maternal and Child Health and Primary Care block grants—have failed, by wide margins, to keep up with inflation. The commitments of entitlement programs have been eroded, for Medicare by perhaps as much as $40 billion, thereby limiting benefits even as the pool of those who are eligible grows.

Most members of Congress know that the fat is long gone and sinew and muscle are now being sacrificed. But successive administrations remain intransigent on raising revenue and Congress has fallen in line. Whether the politicians are leading the public or vice versa, the current

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Table 1

The Budget of the United States: Revenues, Outlays, and Deficits, Fiscal Years 1962–1988*

Fiscal Year	As Percentage of GNP			In Billions of Dollars		
	Revenues	Outlays	Deficit or Surplus	Revenues	Outlays	Deficit or Surplus
1962	17.9	19.2	−1.3	99.7	106.8	−7.1
1963	18.1	18.9	−0.8	106.6	111.3	−4.8
1964	17.9	18.8	−0.9	112.6	118.5	−5.9
1965	17.4	17.6	−0.2	116.8	118.2	−1.4
1966	17.7	18.2	−0.5	130.8	134.5	−3.7
1967	18.7	19.8	−1.1	148.8	157.5	−8.6
1968	18.0	21.0	−3.0	153.0	178.1	−25.2
1969	20.1	19.8	0.3	186.9	183.6	3.2
1970	19.5	19.8	−0.3	192.8	195.6	−2.8
1971	17.7	19.9	−2.2	187.1	210.2	−23.0
1972	18.0	20.0	−2.0	207.3	230.7	−23.4
1973	18.0	19.2	−1.2	230.8	245.7	−14.9
1974	18.6	19.0	−0.4	263.2	269.4	−6.1
1975	18.3	21.8	−3.5	279.1	332.3	−53.2
1976	17.6	21.9	−4.3	298.1	371.8	−73.7
1977	18.4	21.2	−2.8	355.6	409.2	−53.6
1978	18.4	21.1	−2.7	399.6	458.7	−59.2
1979	18.9	20.6	−1.6	463.3	503.5	−40.2
1980	19.4	22.1	−2.8	517.1	590.9	−73.8
1981	20.1	22.7	−2.6	599.3	678.2	−78.9
1982	19.7	23.8	−4.1	617.8	745.7	−127.9
1983	18.1	24.3	−6.3	600.6	808.3	−207.8
1984	18.1	23.1	−5.0	666.5	851.8	−185.3
1985	18.6	23.9	−5.4	734.1	946.3	−212.3
1986	18.4	23.7	−5.3	769.1	990.3	−221.2
1987	19.3	22.6	−3.4	854.1	1,003.8	−149.7
1988	19.0	22.3	−3.2	909.0	1,064.1	−155.1

*These data indicate the sharp increase in the deficit that occurred when taxes were reduced in 1982. (Source: Congressional Budget Office.)

policy—no new taxes—appears to have broad public support. Thus, for government programs, their beneficiaries and their advocates, the struggle to stay whole has been replaced by the struggle to stay alive.

In this circumstance, it is encouraging that appropriations for the NIH during the past decade have grown steadily in current dollars and also, except for a slump between FYs 1979 and 1982, in constant dollars.[2] However, in the pressure cooker that the annual appropriations process has become, generosity toward the NIH comes increasingly at the expense of other programs. The beneficiaries of, and advocates for, these programs have become both strident in protesting reductions and insistent on a larger share of the available funds. In this atmosphere the NIH costs have come under intense scrutiny.

The most recent challenge occurred in the spring of 1988 during the presentation of the president's budget for FY 1989. The director of the NIH stated that the agency would need a 16.1% increase (later corrected to 14.1%) in order simply to maintain the same level of program activity that was being supported in FY 1988. This aroused House Appropriations Committee interest in why the requirement was so much higher than that expected from inflation, and revived old misgivings about the seemingly inexorable increases in the average "cost" of a grant. When the dust had settled, the Department of Health and Human Services (DHHS) Inspector General was asked by the House Appropriations Committee to "review a sample of extramural grants to determine whether these costs are being well managed. To the extent possible, the Committee would request that this review include information on manpower utilization, salary growth and procurement practices."[3]

The rising cost of biomedical research has suddenly become a central public issue and could join the rising cost of medical care as a perennial one.

Definition of the Cost Problem

The precise nature of the dis-ease that prevails in Congress and elsewhere about research costs is still inchoate. Under the general rubric of cost, at least three discrete issues can be discerned: the average cost of a research grant, the total cost of the

NIH program, and the annual escalation in the current services requirements in excess of inflation.

Average Cost of a Grant

The problem of the average cost of a grant, as perceived by Congress, is that the unit cost for a research project grant (RPG) rose from $87,720 in FY 1978 to $184,431 in FY 1988.[*] Granting that "cost" is something of a misnomer, and that what is actually at issue is the amount that the NIH agreed to pay for the proposed scope of work, the increases are certainly impressive.

Magnitude of Increases

Averages can mask important details; in the interest of greater precision, more specificity is warranted. The major formal categories of the NIH budget[2] include research grants, research training grants, research and development contracts, and intramural research, as well as several others less germane to the topic under examination. The category of research grants comprises three subcategories: research project grants; research center grants, including General Clinical Research Centers and Biotechnology Research Centers; and other research grants, including career awards, Biomedical Research Support Grants (BRSGs), and Minority Biomedical Research Support Grants (MBRSGs).

The subcategory of research project grants—the average dollar size of these was just cited—is itself not homogeneous but includes a substantial number of discrete instruments of support: Traditional Research Project (R01) Awards; Research Program Project (P01) Awards; US–Japan Cooperative Medical Science Program (R22) Awards; New Investigator Research (R23) Awards, currently being phased out and replaced by FIRST (First Independent Research Support and Transition) (R29) Awards; Phase I and Phase II SBIR (Small Business Innovative Research) (R43 and R44) Awards; Research Project Cooperative (U01) Agreements; Outstanding Investigator (R35) Awards; MERIT (Method for Extending Research in Time) (R37) Awards; and Hazardous Substance Basic Research (P42) Awards.

Some of these types of awards are quite old, but many are of recent vintage. Their average "costs" in FY 1988 varied over a wide range—from under $50,000 for R23 and R43 awards to almost $1.0 million for P01s and P42s.[2,4] The R01s and P01s accounted for about 84% of all research project grant expenditures in FY 1988. The average award size for R01s increased over the decade FYs 1979–1988 from $78,117 to $155,415, a slightly more rapid rate than for the P01s, which grew from $570,377 to $850,950.[2,4]

Effect of Inflation

While these increases are large, they coincide with an epoch during which inflation was one of the country's major economic problems. Average prices can be discounted for inflation by the use of several indices: the implicit Gross National Product (GNP) deflator or some specific component thereof[5]; the Consumer Price Index (CPI)[6]; or the Biomedical Research and Development Price Index (BRDPI). This latter was developed for the NIH by the Bureau of Economic Analysis of Department of Commerce[7,8]; its validity has withstood challenge well, and accordingly it is used throughout this paper except where otherwise indicated.

Discounted for inflation, the average price paid for R01s has increased very slightly over the last decade, from $78,117 to $85,888; that for P01s has actually declined, from $570,377 to $470,268.[4] Examined over an even longer epoch—FY 1970 to FY 1988—the average constant dollar size of an R01 award increased at an average annual rate of 1.3%, while that of a P01, after a sharp rise in the early 1970s, declined at an average annual rate of 1.3% between FY 1975 and FY 1988. If account were taken of the "negotiated reductions" effected in FY 1988, the constant dollar prices paid for average R01s and P01s would have been $86,574 and $476,803, respectively. These differences would affect the average growth rates cited only trivially. Thus, the pattern of the last decade is a perduring one.[4]

In view of the modest growth in size of these awards after discounting for inflation, the issue would not be worthy of extended analysis under ordinary circumstances. But because of the intense interest it holds for Congress and for the Inspector General, closer examination, focusing on the R01 awards, is in order. The R01 is the best known and understood as well as the principal instrument of support in the NIH portfolio. On the average, it provides partial salary support for one principal investigator (PI), one other doctoral-level investigator, and about two nondoctoral research personnel, a pattern that has persisted for a couple of decades.

Basis for Increases

Several factors probably contribute to the observed small real increase in the average size of awards for R01s.

Indirect Costs. A disproportionately rapid rise in indirect costs is one significant factor. Between FYs 1979 and 1988, the real size of the average R01 attributable to direct costs increased from $55,497 to $58,019, or 4.5%, while that due to indirect costs rose from $22,574 to $27,584, or 22.2%. Actually, in four of the last nine years, direct costs were below the FY 1979 base, while indirect costs rose steadily and substantially.[9]

Personnel Charges to Grants. Since about 65% of all funds budgeted in the average R01 award are for personnel, the NIH conducted a detailed study of salary changes in approved budgets over the period FY 1981–1985.[10] The number of PIs per award is, by definition, one; it did not change. Among PIs, the degree of participation rose for investigators with clinical doctorates, declined for those with academic doctorates, and declined in the aggregate, as reflected in the change in full-time equivalent personnel (FTEs); there was a small

[*]For technical accounting reasons, data reported by the NIH on awards and on obligations differ slightly, as explained in the Definition section of the *NIH Data Book 1988*.[3] The time series describing obligations is one year more current than that for awards and so was used wherever data for FY 1988 and estimates for later years were cited.

increase in the percentage of staff approved to receive compensation from the award and a substantial percentile increase in the amount of compensation approved. The pattern for non-PI doctoral personnel was different: the number of personnel declined but the average degree of participation increased, resulting in a modest increase in the number of FTEs; the percentage of staff approved to receive compensation increased substantially (that is, fewer worked for no pay), and the amount of compensation approved for payment increased modestly. The pattern for nondoctoral personnel did not follow either of these patterns: both the number of personnel and degree of participation decreased, as therefore did the number of FTEs; the number approved for compensation from the award increased slightly, as also did the approved level of compensation.

Although the patterns of the number, commitment, and compensation of personnel varied by type of worker, the important net effect was that the real annual growth rate in compensation from the award increased only for the PIs: by 3.5% for those with clinical doctorates and by 0.9% for those with academic doctorates. For all other workers, the annual growth rate in compensation from the award declined: 2.3% per annum for non-PI personnel with doctorates and 3.3% per annum for nondoctoral personnel. In absolute terms, compensation from the grants, unadjusted for inflation, increased between FYs 1981 and 1985 from $12,420 to $16,648 for investigators with academic doctorates, while for those with clinical doctorates, compensation went from $17,797 to $26,353 over the same period.

Another NIH study of the aggregate personnel budgets of all R01 awards in 1980 and in 1985 showed a direct cost increase in the constant-dollar amounts approved, equivalent to annual growth rates of 0.5% for competing awards and 1.5% for noncompeting awards.[11]

These data suggest that salary increases in excess of inflation make only a small contribution to the observed constant-dollar increase in the size of the average R01.

The NIH analyses of salary changes are not entirely concordant with the conclusions drawn by the DHHS Inspector General in his March 1989 Preliminary Report to Congress,[12] based on an examination in eight institutions of a sample of grants. The differences between the NIH's and the Inspector General's studies include the time spans covered (1981–1985 versus 1984–1988), the item examined (budgeted versus paid salary), the types of awards analyzed (NIH R01s versus a mix of grants and contracts supported by various agencies), the inflator used (BRDPI versus CPI), and the field of science pursued (all biomedicine versus 50% non-biomedicine). The Inspector General's study needs refinement, extension, specification, and sophistication to be acceptable; the NIH's needs updating.

Quality of Research. A third factor possibly contributing to the small constant-dollar increase in the average award size relates to the quality of the research. The experience of the NIH is that the "better" the priority score accorded an application by study sections, the larger the size of the award approved and received.[4] The frequency distribution of priority scores has shifted during the last decade,[9] with a growing proportion of applications being deemed more meritorious, that is, with priority scores better than 150 or 175. Between FYs 1979 and 1988, the percentage of eligible applications with scores of between 100 and 150 rose from 10% to 27% of this total, while those with scores of between 100 and 175 increased from 22% to 41%. Even more striking is the representation in the award pool of applications accorded the highest technical merit. Over the same interval, awards with scores of between 100 and 150 soared from 20% to 71% of the total while those with scores of between 100 and 175 rose from 42% to 91%. The enhanced concentration in the award pool of the best—and most expensive—applications would tend to increase the average award size.

This exploration of possible bases for the observed growth in the average size of an R01 award should not distract from the central reality. Once inflation has been discounted, only a very small increase has occurred in the size of the traditional (R01) research award.

The Total Cost of the NIH Program

Another context in which the concerns about increasing costs are being articulated relates to the total annual federal investment in the NIH program. As noted earlier, this has increased steadily in current dollars and also, after a small fall between FYs 1979 and 1982, in constant dollars.

In the last decade, the number of R01 awards increased from 14,320 to 16,499, and the current-dollar expenditures, from $1.107 billion to $2.548 billion; the number of P01 awards grew from 456 to 746, while funding expanded from $253 million to $625 million. Thus, these two types of awards, which jointly accounted for about 85% of all research project expenditures in FY 1988, have expanded both in numbers and in obligations, whether the latter be in current or constant dollars.[4]

As previously noted, several new research project grant mechanisms have been created recently. Since new instruments of support generally expand at a rapid rate before eventually stabilizing, it is premature to discuss trends for them. But the absolute level of these awards is worth noting. The New Investigator and FIRST award programs are in the process of merging; together, they aggregated to almost 1,500 awards (1,472) in FY 1988 and accounted for $120 million in obligations. There were 598 MERIT awards and 71 Outstanding Investigator Awards during the same year. Compared with 16,500 R01s, the number of awards under the new mechanisms is small but not insignificant. Another characteristic of them is worth noting: they tend to carry a longer than average number of years of committed support.

Direct NIH investments in training have risen slightly in current dollars but fallen dramatically when discounted for inflation, continuing a trend that has been evident for al-

most two decades.[2,13] In FY 1969, about 2.5 times as many real dollars per year were invested in research training as was the case in FY 1988. Moreover, the number of FTE trainees has fallen significantly from the early-1970s level and the average real-dollar support per trainee is now at about 60% of the FY 1969 level.[2,13] Curiously, collateral evidence indicates that the first-year and total graduate enrollments of American students in the biosciences[14] as well as the number of Ph.D.s awarded to U.S. citizens[15] and the number of American postdoctoral students in these fields have been quite stable.[14] If, as many believe, the support of the training of graduate students has been, and continues to be, shifting imperceptively from training grants to research project grants, it is puzzling that the trend has not increased the constant dollar expenditures for an average R01 more extensively. Perhaps graduate students are paid less than technicians when the students replace them.

Clearly, the last decade has seen real and substantial growth in the overall extramural program of the NIH accompanied by some changes in the distribution of funds among various activities.[2] Indirect costs, though not the largest expenditure, have grown at the most rapid rate. The constant-dollar obligations for indirect costs, research projects, and intramural research were higher in FY 1988 than in FY 1978, those for research centers were about the same, while those for training and research contracts declined. The most dramatic relative expansion has been in the research project grant category, with other instruments of support — except for training and contract research — holding their own.

Expenditures for research related to the acquired immunodeficiency syndrome (AIDS) accounted for perhaps 20% of the increases over the decade.[16]

The Rising Current Services Requirements

Perhaps the most interesting problem is why the current services requirements for the NIH budget seem to have increased recently at a rate significantly more rapid than that of inflation. In the development of its annual budget request, every federal agency must submit an estimate of how large an appropriation it would need to maintain in the next fiscal year the level of program activity that is under way in the current fiscal year. This is called the current services requirement; as a first approximation, it should amount to the current year's appropriation plus an adjustment for inflation.

Estimates of current services requirements warrant more than casual discussion. Ever since enactment of Gramm-Rudman-Hollings, they have assumed increasing importance as Congress has sought to adjust available resources to the statutory limits imposed on the magnitude of the deficit. The several forms taken by perennial proposals for "freezes" contain implicit assumptions about current services requirements. Out-of-line estimates draw quick and intense scrutiny. As noted earlier, the NIH's total current services estimate for FY 1989 was 14% higher than the FY 1988 level, sufficiently beyond expectations to prompt Congress to ask the Inspector General to look into the matter. The same phenomenon occurred in 1989, when the NIH's current services estimate for FY 1990 required a 12% increase, again well in excess of inflation.[17] Since growth, positive or negative, has been modest during the last few years for other types of support mechanisms, the basis for the observed phenomenon resided in the research project grant category, which required an 18% increase.

At least three factors involving project grants could account for the observation — real growth, "negotiated reductions," and project period extension. These are difficult to tease apart and it may therefore be helpful to review — in idealized form and in isolation — the implications that each carries for project grant budgets. A small digression to explain how the NIH financing system operates may facilitate understanding these phenomena.

Throughout the past decade, the NIH has annually tendered about 4,500 three-year R01 awards; the project period for these awards averaged three years. The 4,500 competing first-year awards are also prebudgeted for future payment in the budgets for the next two years for the second and third years of support. By long-standing policy, only the first year award is obligated from the current year's appropriation; out-year noncompeting commitments have, however, first claim an out-year funds. Thus, in *any* steady-state year, there would be about 4,500 competing awards and about 9,000 noncompeting continuation ones, a total of about 13,500 awards to be paid (Fig. 1). Under these circumstances the current services budget for a steady-state year should reflect the costs of 4,500 competing awards and 9,000 noncompeting awards at their prior year's costs, adjusted for projected inflationary increases (Fig. 2).

Program Growth

If the number of competing awards were to grow from the steady-state level of 4,500 by 500 per year for three years (Fig. 3), this expansion in the *competing* pool would increase seriatim the size of the *noncompeting* pool for the next four years until a new steady state would be attained, two years after the number of competing awards stabilized at the new level of 6,000. In any year after growth had begun but before the new steady state had been reached, the current services requirements would exceed expectations by a considerable margin. Consider the current services requirements for the fourth year after the expansion began (Fig. 4). The expectation would be simply an inflationary escalation of the costs of 6,000 competing and 10,500 noncompeting awards funded in the prior year. The actual costs, however, must cover the inflation-escalated out-year costs of the earlier increases in competing awards, now annually expanding and showing up in the noncompeting pool.

As already indicated, the NIH's research project grant programs have experienced modest growth for the

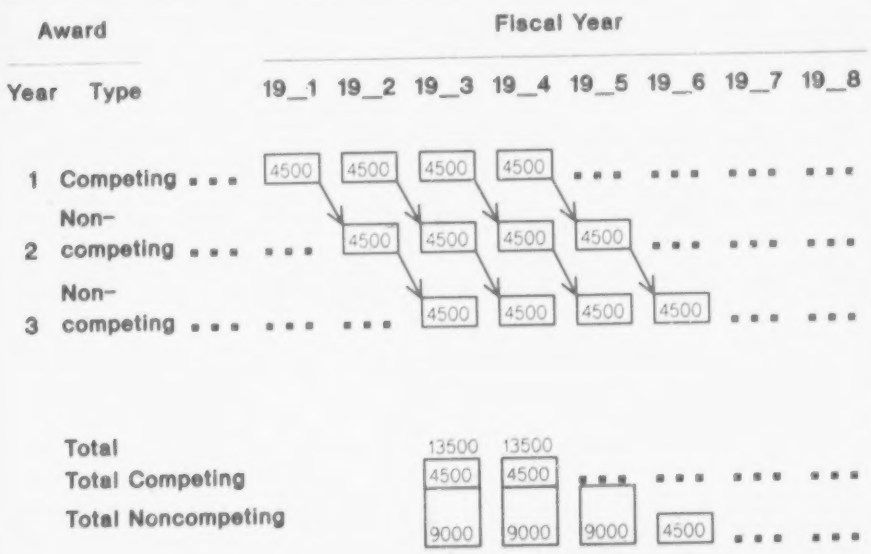

Figure 1. **An idealized snapshot in time of the NIH budgeting process, showing the effect, on the pool of noncompeting awards, of the competing awards made in FYs 19_1 through 19_4. The scheme depicts a steady-state situation in which 4,500 competing awards, each with a project period of three years, are made each year. The dots imply that the same process preceded or followed the events depicted. Each competing first-year award is funded from the appropriation for that year; the second and third (noncompeting) years of each award are funded in, and from the appropriations for, subsequent years. The number of awards in the noncompeting pool for any year is the sum of the number of competing awards made in the two previous years.**

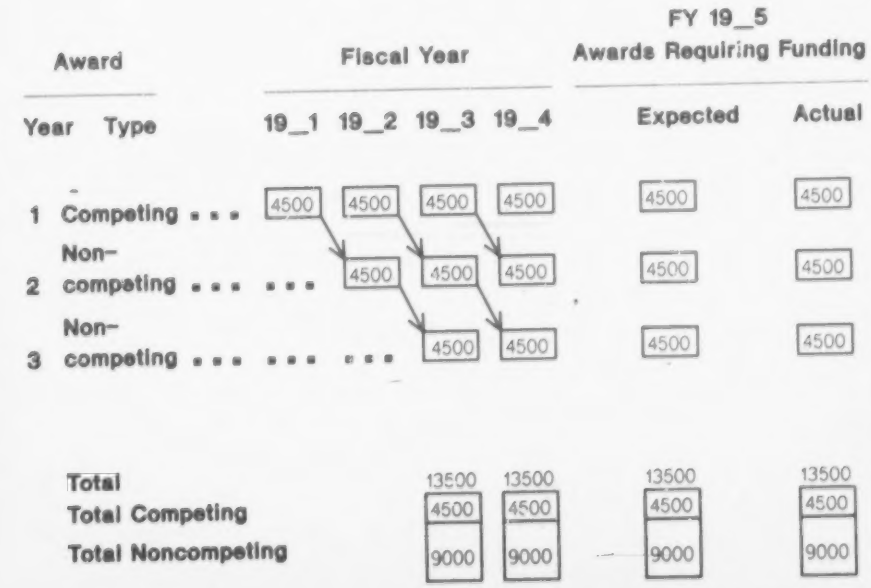

Figure 2. **The comparison, idealized, of actual and expected FY 19_5 current services requirements, i.e., the number of awards that must be funded (at inflation-adjusted costs) in a year for which a budget is submitted, e.g., FY 19_5. The number of competing awards is, by definition, the same number as that in the prior year; the number of noncompeting awards is the number to which commitments had been made in previous years. Under the assumptions specified in Figure 1, the expected and actual numbers coincide.**

last decade, a fact that explains, in part, why the current-services-requirements estimates have been unexpectedly high in the last few years.

"Negotiated Reductions"

The large "negotiated reductions" in award size that have been imposed in FYs 1986, 1988, and 1989 also distort current services estimates; such distortion is most easily and quickly apparent for competing awards. Regardless of the dynamics of the *noncompeting* pool, the number of competing awards in a current services projection is, by definition, exactly the same as that in the current year; therefore, the appropriations needed to fund that number should be identical in the two years except for an inflationary adjustment. However, in the spring of 1989, the NIH's FY 1990 current services projection for the same 5,324 competing awards was almost 17% higher than their FY 1989 costs.[17] Why? Recall that the FY 1989 competing awards had been arbitrarily reduced by 10.0%. Had the current services requirements been based on the amount approved by the study section, prior to the "negotiated reduction," the current services projection would have been just about equal to the FY 1989 costs plus inflation. The apparently disproportionally high current services estimate for competing awards is, in a sense, an artifact of "negotiated reductions."

"Negotiated reductions" are, of course, applied to the current-year amounts of both competing and noncompeting awards, although the magnitude of the cuts has been less for the latter than the former.[17] The current-services-requirements projections are distorted for both pools. However, other factors, such as real program growth and project period extension, may also be exerting influence on the noncompeting pool; thus, the effect is not as unambiguously attributable to one specific cause as is the case for competing awards.

Project Period Length

The third factor that can affect the current-services-requirements estimates is the length of the project period. For a long time, the average project period of R01 awards was very close to three years. Consider the ef-

fect of extending it from three to four years. Nothing would happen immediately after adopting a policy to extend project periods; the pools of competing, noncompeting, and total awards remain stable (Fig. 5). But in the third year after the first extended project period awards were tendered, there would be an abrupt increase in the noncompeting pool and a simultaneous rise in the current-services-requirements estimates, in excess of inflation, to cover the expanded number of noncompeting continuations (Fig. 6).

What has actually been happening to the average project periods of NIH awards? For the new types of research project awards that originated in the 1980s, such as the New Investigator and FIRST awards, five-year project periods were the norm; Outstanding Investigator awards were of even longer duration. Starting in FY 1985, the number of research project grants with three-year project periods began to decline and that of those with five-year periods to rise, for the eligible grants (that is, those that were approved) but also, especially, for those actually awarded.[9] By FY 1988, the incidence of five-year awards exceeded 50%, up from less than 20% in FY 1984.

Looked at in somewhat more detail (Fig. 7), a significant number of five-year-program project (P01) awards have been made throughout the decade, but in recent years the fraction of these has increased abruptly while that of three-year awards has simultaneously fallen. For R01s, a significant redistribution of project period lengths of awards began in FY 1985 and continues.[4] Stated another way, the average lifespan of an R01 award increased slightly between 1979 and 1980 but increased substantially after FY 1985, from 3.30 years to 3.92 years in FY 1988.[2]

To project the impact of extending project periods, the expected size of the noncompeting R01 pool can easily be calculated using two items of actual data: the number of competing awards for a given year and the frequency distributions of their project periods. To test for validity, the calculated and observed numbers in the noncompeting pool from FY 1983 through FY 1988 were compared; the calculated numbers varied less than 1% from the actual ones, indicating

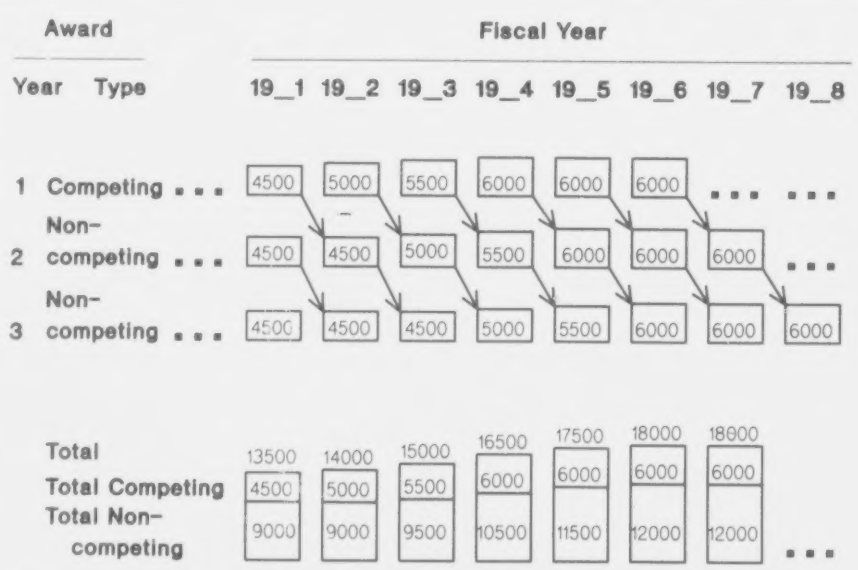

Figure 3. **An idealized snapshot in time of the effect on the noncompeting award pool of (1) increasing the number of competing awards from the steady-state level that prevailed before FY 19_1 by 500 per year through FY 19_4, and (2) thereafter stabilizing that number at the new (6,000 per year) level. All awards are assumed to have three-year project periods. The size of the noncompeting pool does not stabilize until two years after growth in the competing pool ends.**

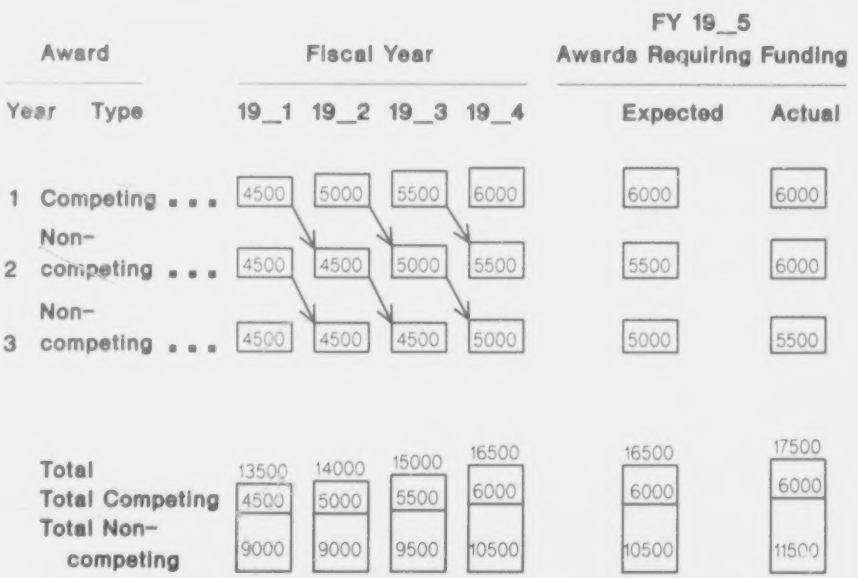

Figure 4. **The comparison, idealized, of the actual and expected FY 19_5 current services requirements, i.e., the number of awards that must be funded (at inflation-adjusted costs) in a year for which a budget is submitted, e.g., FY 19_5, under the circumstances of program growth assumed in Figure 3. The actual number exceeds the expected because the former must include the increased number of commitments for third-year support that were occasioned by the increased number of FY 19_3 competing awards, as well as the increased number of commitments for second-year support occasioned by the increased number of FY 19_4 competing awards.**

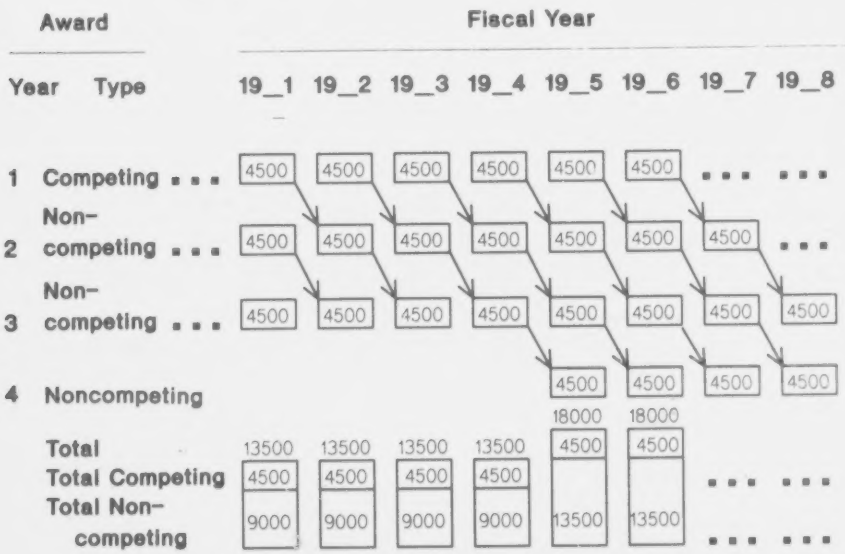

Figure 5. **An idealized snapshot in time illustrating the effect upon the noncompeting award pool of making only one change: extending the duration of project periods from three to four years, beginning in FY 19_2. No impact becomes visible until FY 19_5, when the first cohort of awards with four-year project periods appear in the noncompeting pool. Thereafter, the new steady state is characterized by a 50% increase in the size of the noncompeting pool and a 33% increase in the total pool.**

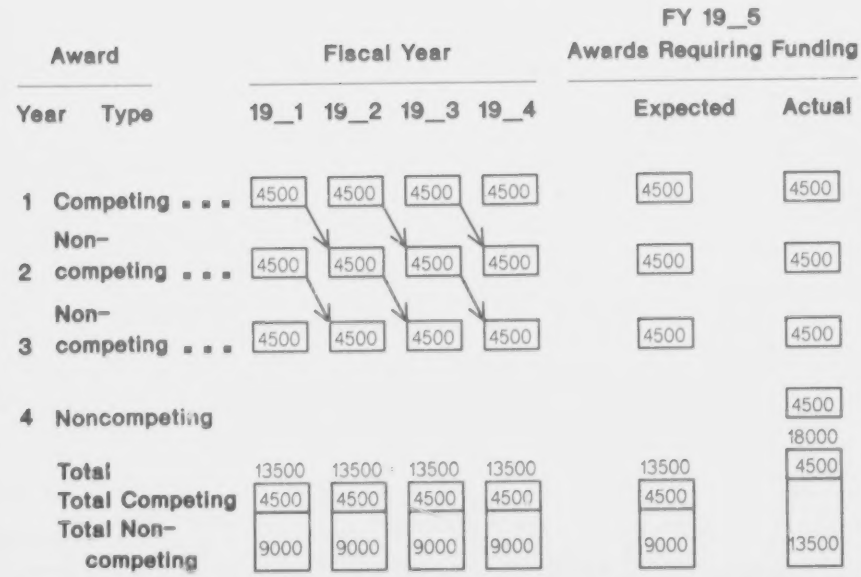

Figure 6. **The comparison, idealized, of the actual and expected FY 19_5 current services requirements, i.e., the number of awards that must be funded in a year for which a budget is submitted, e.g., FY 19_5, under the circumstances of project period extensions assumed in Figure 5. The actual number exceeds the expected because it must include the first cohort of extended-project-period awards that were made in FY 19_2.**

the reliability of the technique (Table 2). Obviously, actual award numbers for FY 1989 and beyond are not available because data for FY 1989, just completed, are not yet compiled. However, assuming for FY 1989 and thereafter a level of competing awards equal to that in FY 1988 and assuming no further change in the frequency distribution of project period durations from that which obtained in FY 1988, the computed size of the noncompeting pool rises through 1992. If the proportion of longer awards were to continue to increase, the noncompeting pool would increase even more rapidly and continue to do so beyond FY 1992.

Another interesting calculation compares the actual (up to FY 1988) and projected (after FY 1988) sizes of the noncompeting pool that resulted from the lengthening of project periods with what they would have been if the distribution of project periods had been frozen in the FY 1984 pattern. Results (Table 2) indicate that the practice of extending the duration of project periods begun in FY 1985 has had an effect, delayed as expected until FY 1988, but promising eventually to reach major dimensions even if the number of competing R01s remains stable or decreases. As can also be inferred, the practice of extending project periods has placed a substantial demand on the FY 1990 appropriation now under discussion in Congress and will place even greater demands, no matter what else happens, on appropriations for FYs 1991 and 1992. Depending on how many competing awards can be made, it could become necessary to find funds for as many as 2,750 "extra" R01s in FY 1992.

The forces at play on R01 awards are also operating on P01s. Moreover, most of the new programs recently included in the research project grant category of the budget are characterized by long project periods.

Discussion

The relative stability in the average size of R01 awards is not widely recognized. It is remarkable, however, that over an era in which science has become much more complex, instruments and equipment much more costly, and competition from industry

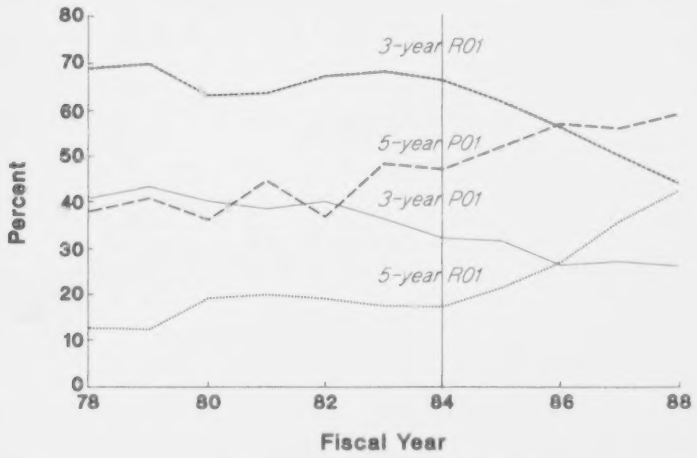

Figure 7. **Distribution of project period lengths of R01 and P01 awards. The percentages of all R01 and P01 awards assigned either three-year or five-year project periods have been plotted. During FY 1984, NIH officials openly encouraged advisory bodies to provide longer support to projects with high scientific merit. Thus, the percentage of both R01 and P01 awards with five-year project periods rose, with a corresponding decline in the percentage of awards with three-year project periods.**

and medical practice for academic talent increasingly intense, R01 award size has increased only at an annual rate of about 1.1–1.3% (depending on the epoch examined) in real dollars. This suggests that significant gains in efficiency and productivity must have been achieved or that funding from other sources has supplemented the federal award in the performance of the scope of work for which the latter was tendered.

Real growth in the size of the NIH program over the decade is somewhat unexpected, in view of the fiscal restraints that have been operative. However, the answer to the question of why NIH-funded biomedical research program costs the government more is simple. There is more of it!

It is difficult to isolate the effect of any one of the phenomena that increase current services requirements, but all are probably contributing, or will soon contribute, to the dis-ease surrounding the NIH budget.

Growth in the number of competing awards, whether steady or episodic, expands the commitment base and results in current services requirements that regularly exceeds what would be expected from inflation alone. The so-called "negotiated reductions" do not alter the fundamental financial resources required to complete a project's scope of work. To the extent that the money "saved" is used to sustain or increase the num-

Table 2

Calculations of the Effect of the Extensions of R01 Project Period Durations on the Numbers of Noncompeting R01 Awards for Fiscal Years 1983–1988 Compared with the Numbers Expected if Project Period Durations Had Remained at the 1984 Level, with Projections for Fiscal Years 1989–1992 That Involve Explicit Assumptions about the Number of Competing Awards and Project Period Durations

	Competing	Noncompeting		
Year	Observed Number	Observed Number	Calculated Number*	Expected Number†
1983	4,737	10,428	10,252	NA
1984	4,122	10,692	10,728	NA
1985	5,209	10,896	10,913	10,890
1986	4,966	11,243	11,113	11,282
1987	5,026	11,501	11,439	11,516
1988	4,651	11,842	11,713	11,543

	Projections			
Year	Assumed Number	Observed Number	Calculated Number‡	Expected Number§
1989	4,651	NA	12,171	11,267
1990	4,651	NA	12,720	10,894
1991	4,651	NA	13,357	10,815
1992	4,651	NA	13,524	10,774

*The values tabulated were calculated from the actual number of competing awards made and the actual distribution of project period durations assigned for each year from FY 1978 to FY 1988.

†The values tabulated for FY 1985 to FY 1988 were calculated from (1) the actual number of competing awards for each year from FY 1978 to FY 1988; (2) the actual distribution of project period durations for each year from FY 1978 to FY 1984; and (3) the FY 1984 distribution of project period durations.

‡The values tabulated were calculated using a number of competing awards for each year from FY 1989 to FY 1992 and a distribution of project period durations for those same years, each of which was equal to the values of those variables in FY 1988.

§The values tabulated were calculated using a number of awards for each year from FY 1989 to FY 1992 equal to that for FY 1988, and a distribution of project period durations for each of those years equal to the distribution that obtained in FY 1984.

ber of competing awards, it inevitably results in an expansion in the commitment base and in unexpectedly high current services requirements for both the competing and the noncompeting grants in the following year. The consequences of project-period extension vary, depending upon concomitant changes in the number of competing awards. Extension per se (that is, going from an average project period of three years — with 4,500 competing awards, 9,000 noncompeting ones, and a total of 13,500 — to an average project period of five years with the same total number of awards) would result in a new steady state, characterized by 2,700 competing and 10,800 noncompeting awards. The increased current services requirements attributable to the expanded noncompeting pool would be offset by the reduced number of competing awards. However, if the transition were to be accompanied by stability in the number of competing awards, the new steady state would be characterized by 18,000 noncompeting awards and a total of 22,500 awards. In this case, the current services requirements, unadjusted to inflation, would rise by 67%. The impact of real growth, occasioned by sustaining the number of competing awards at or near the pre-extension level, would, whatever its magnitude, be slow to appear and slow to respond to control measures.

Project period extension also *reduces award rates* by delaying the interval before a noncompeting award and the funds associated with it reenter the competing pool. Since, on the average, noncompeting awards remaining in that pool would have had award rates of about 55%, had they reentered competition, the nominal award rate is heavily weighted toward that for new competing awards, that is, about 25%. Thus, during the transition years in which project period length is being systematically changed, nominal award rates reflect a reality that is substantially different from that in the steady state.

The greatest concern would seem to be the impact of project period extension, because unless the number of competing awards declines, it will inexorably increase the size of the noncompeting pool over the next several years, and therefore increase funding requirements, precisely coinciding with reduced growth in real federal resources and ever keener competition for them. While lengthening project periods, at least selectively, is a highly desirable goal, adoption of a policy to do it is not without its price. Unless there is a reduction in the number of competing awards, the magnitude of downward "negotiations" will be virtually inescapable, unless there are large increases in appropriations.

Conclusions

During the last decade the total appropriations for the NIH have grown in current as well as constant dollars. Constant-dollar expenditures for indirect costs and research project grants have increased, as also has the number of the latter, while constant-dollar expenditures for research centers, training, and research contracts have shrunk. The most impressive redistribution in emphasis has been toward research project grants.

The size of the average R01 award, discounted for inflation, has grown at an annual rate of 1.1% during the last decade and 1.3% since FY 1970; that of the average P01 had declined over the same periods, after a slight rise in the early 1970s.

The modest rise in the real (constant-dollar) size of the average R01 reflects, inter alia, disproportionately rapid increases in indirect as compared with direct costs, growth in excess of inflation in compensation to PIs, especially those holding clinical doctoral degrees, and increased density in the pool of awards of applications accorded the most meritorious scores by the peer review system.

The regularity with which current-services-requirements estimates for the NIH exceed inflation reflects real growth in the program, particularly in the category of research project grants; the artifact of basing calculations on the post- rather than pre-"negotiated" levels of awards in the "current" year; and the extent to which the project periods of awards have been extended. The effect of lengthening project periods is slow to appear, but unless accompanied by the award of fewer competing applications, inexorably swells the pool of noncompeting awards; decisions in this area undertaken in 1985 and continued at least through FY 1988 will very significantly increase current services requirements in FYs 1991 and 1992.

Members of the NIH staff have been immensely helpful and responsive to requests for data. Particular thanks are due Robert F. Moore and Nadine Sutton, Information Systems Branch, DRG, Dr. William E. Rhode, Dr. Patricia E. McKinley, and Dr. Charles R. Sherman of the Office of Science Policy and Legislation; and H. Richard Miller and Anne Sumner of the Division of Financial Management. Thanks also to my colleague, David M. Moore, for the calculations in Table 2.

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ROBERT G. PETERSDORF, M.D.

Three Easy Pieces

Abstract—The author provides information about and analyzes three issues confronting academic medical centers in the realms of education, patient care, and research. (1) In the educational realm, he indicates why medical centers must play an expanded role in training primary care physicians, explains the dangers of not doing so, and describes ongoing and proposed approaches and reforms for achieving this goal. (2) In the arena of patient care, he explains why modifying physician reimbursement policies is essential for more physicians to develop careers as generalists. Other more controversial physician payment reform measures and their implications for health care and academic medical centers are discussed; the author urges that benefit to patients always be the first concern of such reforms, even at the expense of more narrowly based interests such as limits in faculty salaries or reduced overages to institutions. (3) Regarding research, he discusses various facets and implications of conflict of interest for biomedical scientists—both the reality of misconduct and the appearance of it—especially as they apply to the growing number and forms of university-industry relationships, and urges that such conflicts be managed within guidelines that clarify expectations and standards in an atmosphere of appropriate disclosure and oversight. He concludes by urging academic medical centers to rise to, rather than avoid, the three challenges he has described. *Acad. Med.* 65(1990):73–77.

In 1970, Jack Nicholson starred in the critically acclaimed film "Five Easy Pieces." Nicholson, in an important lead role that helped to establish his career, played a brilliant classical pianist from an eccentric musical family. He had abandoned his family's rich musical tradition in favor of the California oil fields, and the film was seen as an exposition of the rootlessness of contemporary American life.

The film's title, deemed provocative and mysterious by many reviewers, actually refers to a practice book used by most youngsters studying the piano.[1] I thought it might be a good metaphor for my remarks, which are meant to be a guide to some issues confronting the academic medical center. In the interest of time, I have discounted the five easy pieces to three, the better to coincide with the education, patient care, and research missions of academic medical centers.

Education

The first of my easy pieces is entitled "Primary Care Overture." Many of you have heard me play this piece before; it is a standard opus in my repertoire. Like Rossini's famous "William Tell Overture," my overture is in danger of becoming known more familiarly as the theme from the "Lone Ranger." Yet I persist in my efforts to seek converts among the academic medical community because I am convinced that our agenda must encompass an expanded role for primary care in our institutions and must include an expanded role in training primary care doctors for our people.

In the 1960s the federal government challenged the academic medical community to expand its capacity to address a perceived shortage of physicians. The response was vigor-

This paper was presented at the opening plenary session of the 100th Annual Meeting of the Association of American Medical Colleges, held in Washington, D.C., October 1989.

Dr. Petersdorf is president, Association of American Medical Colleges, Washington, D.C. Correspondence may be addressed to him at AAMC, One Dupont Circle, N.W., Suite 200, Washington, D.C. 20036. Reprints will not be available.

RESEARCH REPORTS

ARTICLES

Comparing Research Activities of Women and Men Faculty in Departments of Internal Medicine

BARBARA A. LEVEY, M.D., NANCY O. GENTILE, H. PAUL JOLLY, Ph.D., HARRY N. BEATY, M.D., and GERALD S. LEVEY, M.D.

Abstract—The findings from a questionnaire prepared by the Association of Professors of Medicine and the Association of American Medical Colleges were published in two reports in 1986 and 1987. These reports assessed the research activities of full-time members of departments of internal medicine in 1982 and 1983. The purpose of the present study was to analyze the data of the earlier reports in order to compare the research activities of women and men who were full-time faculty in departments of medicine during the time period originally surveyed. More than half of the faculty women who responded (52%) were less than 40 years old, compared with 23% of the faculty men. Sixty-seven percent of the women held the rank of instructor or assistant professor, in contrast to 40% of the men holding these ranks. Although the faculty of both genders reported generally the same proportions of time devoted to research, the women researchers with M.D. degrees had significantly less National Institutes of Health (NIH) grant support than did their counterparts who were men. Since this difference may have been a function of age, the authors compared NIH grant support of the faculty men and women with M.D. degrees who were 40–59 years old. Even in this older group, significantly fewer of the faculty women had NIH grant support than did the men (16% versus 30%). Furthermore, the percentage of designated laboratory space was significantly lower among the faculty women, regardless of degree (M.D., M.D./Ph.D., or Ph.D.). Further investigation is warranted to monitor the progress of women attempting to develop their research careers and to assess their overall clinical teaching and administrative roles in departments of medicine. *Acad. Med.* 65(1990):102–106.

Discussions of the progress of women in medicine, and more specifically, in academic medicine, appear cyclically in the scientific literature.[1–5] Relman[3] stated in 1980 in an editorial, "Here Come the Women," that internal medicine was the favorite specialty among women medical school graduates. The following year Braslow and Heins,[4] in a comprehensive paper, "Women in Medical Education," expressed concern for the underrepresentation of women at the level of full professors. Koshland,[2] in a 1988 editorial published in *Science*, commented on the relative underrepresentation of women in the higher echelons of academia and industry. More recently, Bickel[5] published a status report on women in medical education in *The New England Journal of Medicine*, writing that the profile of women in medical education looks much as it did at the beginning of the decade and noting that faculty promotion policies strongly favor productive researchers. Bickel referred to unpublished data regarding research efforts of women in departments of medicine and also extracted data from two reports[6,7] that focused on the extent of research activities of full-time faculties in academic departments of internal medicine. Neither of these reports addressed specifically the degree of involvement of women who were internal medicine faculty in research. The purpose of the present study was to analyze the data from the survey on which these two earlier reports were based in order to compare the research activities the women and men who were full-time faculty in academic departments of medicine during the period covered by the survey, 1982 and 1983. These were years in which the number of women physicians was increasing at a greater rate than that of men physicians.[8]

Method

The method of the 1982–1983 survey has been described[6]; a brief summary follows.

The survey used data from the Fac-

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ulty Roster of the Association of American Medical Colleges (AAMC). The Faculty Roster is a computer-based system containing data on full-time faculty of accredited medical schools in the United States. At the time a faculty member is first appointed, a Faculty Roster form is completed either by the new faculty member or by an administrator of the medical school. The file is updated by the medical school after each promotion, granting of tenure, transfer to another institution, or termination of the faculty member. The form includes questions in five groups, providing background information, data about current appointments, professional employment history, and information about education and training. It does not contain detailed information about research activities.

The 1982–1983 survey also used data from a separate research activity form devised by members of the Association of Professors of Medicine Task Force on Manpower Needs with the assistance of staff members of the Association of American Medical Colleges. Research activity was defined as "an activity performed with the objective of developing knowledge which usually leads to publication and which may be the basis for funding support." Questions were designed to ascertain research effort and sources of funding in the year before the 1982–1983 survey, as well as two, five, and ten years earlier; previous research training, use of research space, and publications that communicate research results.

A record outlining demographic and current appointment information was generated from the Faculty Roster system for each full-time, salaried faculty member previously listed in the system as a member of the department of internal medicine at an accredited medical school. All the Faculty Roster records and blank research activity forms were distributed to the chairmen of the departments of internal medicine in all U.S. medical schools. They distributed these materials to the faculty members in their departments and asked them to complete, verify, or correct the Faculty Roster records and to fill out the research activity forms. When this had been done, all the completed research forms and verified roster records were forwarded to the Faculty Roster at the AAMC.

Information included in the Faculty Roster database was verified or updated from the materials received, and the faculty data that had not been in the system were entered.

Table 1

Numbers and Percentages, by Age Group and Academic Rank, of 7,015 Men and Women Faculty in Internal Medicine Departments, 1982–1983*

Category	Men		Women	
	No.	%	No.	%
Age group†				
Younger than 40	1,615	23	485	52
40–59	4,533	65	387	42
60 or older	856	12	58	6
Missing	11	—	2	—
Total	7,015	100	932	100
Academic Rank‡				
Instructor	282	4	130	14
Assistant Professor	2,522	36	493	53
Associate Professor	1,881	27	183	20
Professor	2,252	32	99	11
Other and missing	78	1	27	3
Total	7,015	100	932	101

*These faculty were among the 7,947 who responded to a survey requesting them to verify their AAMC Faculty Roster record and to complete a research activity form from the Association of Professors of Medicine. (Complete data were not available for some respondents.) A total of 11,293 faculty were sent the survey materials.

†Chi-square for age group and gender = 358.74; $p < .0001$.

‡Chi-square for academic rank and gender = 332.2; $p < .0001$.

Survey Compliance

There were 11,293 Faculty Roster records generated for the survey; these and the same number of blank research activity forms were sent to departments of internal medicine at U.S. medical schools in the manner previously described. Complete data that could be used in the present study were returned by 7,947 faculty members. At the time of this survey there were 1,346 women in departments of internal medicine, representing 11.9% of the 11,293 faculty members who were sent the survey materials. A total of 932 women responded to the survey, which is 11.7% of the 7,947 faculty who responded. The numbers of responses to individual questions varied; that is, not all faculty members answered all the questions. For all the variables characterizing faculty members, there were no significant differences between the group of faculty who responded and the total group of full-time faculty to whom the Faculty Roster and research activity forms were sent.

Method of Analysis

As the research activity forms were returned, they were edited for accuracy, and missing answers were distinguished from zero answers. These data were merged with the full, verified record of the faculty member in the Faculty Roster database, using the member's Social Security number as the identifier. A more detailed description of these analytic procedures can be found in an earlier publication.[6]

Results

Analysis of the distribution of respondents by age and gender (Table 1) shows that the largest percentage of the women faculty (52%) were less than 40 years old, compared with 23% of the men in this group. In contrast,

Table 2

Numbers and Percentages, by Percentage of Effort Spent in Research, of 7,793 Men and Women Faculty with Either M.D., M.D./Ph.D., or Ph.D. Degrees Who Were in Internal Medicine Departments, 1982–1983*

% Effort in Research	Faculty with M.D. Degrees				Faculty with M.D./Ph.D. Degrees				Faculty with Ph.D. Degrees			
	Men		Women		Men		Women		Men		Women	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0	1,747	29	206	32	79	16	7	17	28	6	14	8
1–20	1,473	25	182	28	84	16	9	23	18	4	5	3
21–40	956	16	90	14	110	22	10	25	21	4	5	3
41–60	790	13	68	10	92	18	7	17	30	6	8	5
61–80	585	10	60	9	85	17	6	15	119	25	16	10
81–100	226	4	30	5	49	10	1	3	261	54	112	68
Missing	174	3	13	2	8	1	0	0	4	1	5	3
Total	5,951	100	649	100	507	100	40	100	481	100	165	100

*These faculty were among the 7,947 who responded to a survey requesting them to verify their AAMC Faculty Roster record and to complete a research activity form from the Association of Professors of Medicine. (Complete data were not available for some respondents.) A total of 11,293 faculty were sent the survey materials.

the highest percentage of men was in the 40–59-year age group. The difference between the ages of the women and the men was highly significant ($p < .0001$). Table 1 also shows the distribution of men and women faculty by academic rank. Sixty-seven percent of the women had the rank of instructor or assistant professor; 40% of the men held these ranks. Thirty-one percent of the women faculty and 59% of the men held the rank of professor or associate professor. These data are highly significant ($p < .0001$), indicating that the women were more likely than the men to be junior faculty.

A preponderance of both the women (68%) and the men (85%) held the M.D. degree only. The percentage of the men holding M.D./Ph.D. degrees (7%) exceeded that of the women with such degrees. It is notable that 18% of the women held the Ph.D. degree only; 7% of the men held this degree only. These differences were also reflected in the total populations of men and women faculty in departments of internal medicine.

The results shown in Table 2 indicate a general agreement of the percentages of the men and the women engaged in research activities, regardless of degrees earned. For example, approximately 74% of the women who had M.D. degrees and 70% of the men with M.D. degrees reported spending 40% or less of their time in research. Almost one-third of all the men and women with M.D. degrees reported spending no time in research activity. Although the numbers of women and men who had Ph.D. degrees was small, it is evident that these faculty members spent a great proportion of their time in research; 78% of the women and 79% of the men reported greater than 60% of their effort was in research; only 18% of the women and 27% of the men with M.D./Ph.D. degrees reported that level of research effort. Similarly, a greater percentage of respondents with M.D./Ph.D. degrees than those with Ph.D. degrees reported no research effort.

Table 3 shows that the percentage of men researchers with M.D. degrees who had National Institute of Health (NIH) funding was roughly equivalent to the percentage of men researchers with either M.D./Ph.D. or Ph.D. degrees who had NIH grant support. In contrast, a much smaller percentage of women researchers

Table 3

Numbers and Percentages of 7,793 Men and Women Faculty in Internal Medicine Departments, Sources of Funding, and Academic Degrees Earned, 1982–1983*

Funding	Faculty with M.D. Degrees				Faculty with M.D./Ph.D. Degrees				Faculty with Ph.D. Degrees			
	Men		Women		Men		Women		Men		Women	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
NIH†	2,227	37	83	13	183	36	13	32	193	40	65	39
Other‡	1,733	29	283	44	228	45	17	43	241	50	81	49
None	1,991	34	283	44	96	19	10	25	47	10	19	12
Total	5,951	100	649	101	507	100	40	100	481	100	165	100

*These faculty were among the 7,947 who responded to a survey requesting them to verify their AAMC Faculty Roster record and to complete a research activity form from the Association of Professors of Medicine. (Complete data were not available for some respondents.) A total of 11,293 faculty were sent the survey materials.

†This group includes faculty who had other sources of funding in addition to their National Institutes of Health funding.

‡The faculty members in this group had internal and external funding from sources other than the NIH, such as the Veterans Administration, the National Science Foundation, and industry.

with M.D. degrees than those with either M.D./Ph.D. or Ph.D. degrees had NIH grant support. Furthermore, the women scientists with M.D. degrees were much more dependent on other external (non-NIH) grant support than were their counterparts among the faculty men. The percentages of both the men and women faculty with M.D. degrees who reported no research funds of any type was high (44% of the women and 34% of the men).

Because of the relative youthfulness of the women in the population studied and the striking difference between the men and the women with M.D. degrees with regard to NIH funding, the authors examined all the faculty members with M.D. degrees who were 40–59 years old with regard to NIH funding (Table 4). Even in this more mature group of faculty, the women reported significantly less NIH funding than did the men. Table 4 also provides an examination of rank in this 40–59-year-old age group. The data show that even in the older age group, the women were significantly more likely than the men to be junior faculty ($p < .0001$).

Additional data not presented in the tables show that a greater percentage of the men than the women faculty reported assigned laboratory space regardless of degree. The percentages of the men versus the women faculty with assigned laboratory space were the following: 50% versus 32% of those with M.D. degrees, 71% versus 65% of those with the M.D./Ph.D. degrees, and 80% versus 67% of those with Ph.D. degrees. In addition, more women than men reported no assigned laboratory space.

Productivity of faculty researchers was assessed by the number of original articles published during the time frame of the survey. A greater percentage of the women faculty had not published an original article: 58% versus 47% for those with M.D. degrees, 43% versus 29% for those with M.D./Ph.D.s, and 29% versus 18% for those with Ph.D. degrees. Of those faculty who had published at least one original article, a greater percentage of the men than the women reported five or more original publications.

A researcher was defined in a previous publication[7] as someone who spent at least 20% of his or her time in research, had at least one original publication within a two-year period of time, and had external funds to support the research or assigned space in which to do the research; it was recognized that, at times, the researcher might be without funds or assigned space. The faculty in the present study who were the principal investigators on NIH grants best fulfilled these criteria. Similar results were found in this analysis when these data were considered by the gender of the researcher.

Table 4

Numbers and Percentages, by Source of Funding and Academic Rank, of 3,779 Men and Women Faculty, Aged 40–59 Years, with M.D. Degrees Who Were in Internal Medicine Departments, 1982–1983*

	Faculty with M.D. Degrees			
	Men		Women	
Category	No.	%	No.	%
Funding†				
NIH‡	1,023	29	45	16
Other§	1,478	42	126	44
None	992	28	115	40
Total	3,493	99	286	100
Academic rank‖				
Instructor	28	1	12	4
Assistant professor	622	17	112	39
Associate professor	1,349	38	106	37
Professor	1,474	42	51	18
Other and missing	20	1	5	2
Total	3,493	100	286	100

*These faculty were among the 7,947 who responded to a survey requesting them to verify their AAMC Faculty Roster record and to complete a research activity form from the Association of Professors of Medicine. (Complete data were not available for some respondents.) A total of 11,293 faculty were sent the survey materials.

†Chi-square for source of funding and gender = 29.92; $p < .0001$.

‡This group includes faculty who had other sources of funding in addition to their National Institutes of Health funding.

§The faculty members in this group had internal and external funding from sources other than the NIH, such as the Veterans Administration, the National Science Foundation, and industry.

‖Chi-square for academic rank and gender = 130.76; $p < .0001$.

Summary and Discussion

The authors found striking differences, as well as some similarities, between the men and the women faculty members of departments of internal medicine in analyzing the data obtained from the research activity forms. The women as a group tended to be younger and lower in rank. More than half the reporting women faculty were less than 40 years old and more than two-thirds held the junior rank of instructor or assistant professor. In contrast, the majority of the men were between the ages of 40 and 59 and held the rank of associate professor or full professor. Notably, the percentage of women instructors and assistant professors exceeded the percentage of associate and full professors even within the 40–50-year age range. (A larger percentage of the women — 18% — than of the men — 7% — held the Ph.D. degree.)

The women with M.D. degrees reported significantly less NIH research support and more research support from non-NIH external funding sources than did the men with M.D. degrees. Even when the more mature age group (40–59) was examined, the men were significantly more likely than the women to have NIH funding. Furthermore, a greater percentage of the men faculty reported assigned research space, and the women faculty tended to have

fewer publications than did the men during the two years surveyed.

Both the men and the women respondents tended to best fulfill the criteria for active researchers when they were principal investigators on NIH grants. Another clear similarity was that a large percentage of the faculty with M.D. degrees, both men and women, did not participate in a significant research effort: the majority of both groups reported spending less than 20% of their professional time in research activities, and almost one-third of both groups reported no research effort. Interestingly, a greater percentage of those with M.D./Ph.D. degrees than those with Ph.D. degrees reported no research effort.

In reflecting on these findings, the authors note that the number of students entering medical schools began to increase sharply in 1955, and the advent of Medicare and Medicaid thrust appreciable direct patient care responsibilities upon departments of medicine. Faculty recruitment has expanded since that time in order to meet the challenges of increased class size and increased numbers of patients. The findings of this study with regard to research efforts suggest that both women and men are being recruited to departments of medicine in appreciable numbers to fulfill the roles of patient care and teaching. However, this does not explain the discrepancies between the activities of the men and women faculty in the areas generally defined as "scholarly pursuits"—that is, those areas evidenced by publications and NIH grant support—at times of promotion and conferral of tenure.

Fletcher[9] cautioned in 1982 that academic women who are physicians should guard lest other activities suffocate their professional growth. The women faculty of internal medicine discussed in this study tended to be younger in age and lower in rank than were the men who were their counterparts; both these characteristics make the women particularly vulnerable in their academic careers. This study has not investigated the professional or personal activities that may have accounted for the difference between the ranks of the men and women in the 40–59-year age group. Further investigations are warranted to monitor as well as assess the progress of women in their academic careers.

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